REMARKS

Reconsideration and reexamination is hereby requested. In view of the amendments requested above, and for the reasons set forth below, applicant requests that the rejection of claims 1-5, 10, 12, 13 and 15, and the objection to claim 11 be withdrawn and claims 1-16 be allowed to issue.

In the office action mailed June 18, 2003, the examiner rejected claims 1, 2, 4, 12 and 13 under 35 U.S.C §102(b) as being anticipated by Weber U.S. 5,864,261. In part 11 of the office action, the examiner observed that applicant's claims only require that the intervening layers are "affecting the amount of the acoustic coupling" and pointed out that "isolating" is a means of "affecting" the coupling. Claims 1, 4 and 10 have now been amended to recite intervening layers that acoustically couple one resonator to another (as distinct from isolating one resonator from another).

In Weber the plurality of contiguous intervening layers 140 acoustically isolates a first resonator from a second resonator. See Weber, column 8, ln. 50-53:

> "Similarly , resonators 100 and 110 are substantially acoustically isolated from resonator 120 by means of a second acoustical stack 140 in the form of an acoustical isolator."

To distinguish applicant's claims from Weber, claim 1 and 4 (as well as claim 10) have been amended to recite:

> "a plurality of contiguous intervening layers of differing materials...the plurality of contiguous intervening layers acoustically coupling the first acoustic resonator with the second acoustic resonator."

Thus the claims now recite a plurality of layers that provide acoustic coupling between the resonators. Because the plurality of layers 140 in Weber isolate resonator 120 from resonator 100 and from resonator 110, the claims, as now amended, do not describe layer 140.

In Weber, a single layer of material in each of the coupling plugs 150 and 151 provides a controlled amount of coupling between resonator 120 and resonators 100 and 110, respectively. See Weber, column 8, ln. 53-56. Thus, in Weber, a single layer of material, namely the material in plug 150, provides acoustic coupling between resonator 120 and resonator 100 and a single layer of material, namely the material in plug 151, provides acoustic coupling between resonator 120 and resonator 110. As a consequence amended claims 1 and 4, which recite a plurality of contiguous intervening layers that acoustically couple the first resonator with the second resonator, do not describe the single intervening layer in Weber that acoustically couples resonator 120 to resonator 100 or to resonator 110.

Weber anticipates the amended claims only if Weber discloses each and every element and relationship recited in the claims. Thus, for the reasons state above, Applicant respectfully submits that Weber does not anticipate claims 1 and 4 as now

amended and submits that these claims should now be allowed. Because claims 2 and 12 are dependent upon claim 1 and because claim 13 is dependent upon claim 4, and because these dependent claims include each and every limitation of the claims upon which they depend, it is respectfully submitted that these dependent claims also are not anticipated by Weber and are now in condition for allowance.

Weber teaches the use of a plurality of contiguous intervening layers for the purpose of isolating one resonator from another and does not suggest, in any manner, that a plurality of continuous intervening layers could be used, instead, to acoustically couple one acoustic resonator to second acoustic resonator. Weber, instead, teaches the use of a single layer of material to acoustically couple one resonator to a second resonator, the cross-sectional area of the single layer of material being selected to obtain the desired amount of coupling between the acoustic resonators. Accordingly, applicant respectfully submits that the claims, as amended, also are not obvious in view of Weber.

The examiner rejected claims 4, 5, 10, 13 and 15 under 35U.S.C.§102(b) as being anticipated by Poirier et al. U.S. 3,568,108. The claims in the present application, however, explicitly recite each resonator as "having a piezoelectric layer made of an <u>insulating</u> material." In contrast, as set forth in

more detail below, Poirier explicitly discloses and claims only those resonators in which the piezoelectric layer is a semiconductor. At no place in the '108 disclosure does Poirier indicate, or even suggest, that a piezoelectric layer that is made of an insulating material could be used instead of a piezoelectric semiconductor. Poirier, instead, teaches that the piezoelectric layer of the resonator must be made of a semiconductor material. As a consequence, the disclosure in Poirier does not anticipate the present claims, nor does the disclosure in Poirier render the present claims obvious.

As demonstrated by the following excerpts, in every instance the Poirier disclosure describes the invention as comprising, in addition to other elements, an acoustic resonator having a piezoelectric layer made of a semiconductor material. Poirier never describes the piezoelectric layer as being made of anything other than a semiconductor. (Emphasis is added in the following quotations).

> "This invention relates to piezoelectric semiconductor devices and more particularly to a thin film piezoelectric semiconductor device...." [col. 1, ln. 7-9]

> "An electromechanical resonator comprises a thin film of suitable piezoelectric semiconductor material...." [col. 1, ln. 68-69]

> "In the present invention, the piezoelectric semiconductor such as CdS is laid down...." [col. 2, ln. 72-73]

> "Reference may be had to the prior art for methods...for forming...films...of the suitable semiconductor materials mentioned herein." [col. 3, ln 26-29]

> "...the active film 49 of piezoelectric semiconductor material." [col. 3, ln. 43]

> "...the passive piezoelectric semiconductor film...." [col. 3, ln 61]

As demonstrated by the above quotations, the Poirier Specification teaches the use of a resonator comprising a piezoelectric semiconductor layer and does not teach the use of a resonator having a piezoelectric layer that is, instead, an insulator.

The fact that Poirier teaches the use piezoelectric semiconductor and "teaches away" from the use, instead, of a piezoelectric insulator, is further emphasized by the fact that the sole independent claim in Poirier describes each resonator as

> "including: an epitaxial film having both piezoelectric and semiconductive properties...." [claim 1, col. 4, ln. 24-26].

Accordingly, it is respectively submitted that Poirier does not disclose a resonator having a piezoelectric layer that is an insulator, but instead explicitly discloses and teaches the use of a piezoelectric layer that is a semiconductor. Because each of the recited claims in the present application include the express limitation that each resonator has a piezoelectric layer made of an insulating material, it is respectfully submitted that claims 4, 5, 10, 13 and 15 are not anticipated by Poirier.

Because Poirier expressly and explicitly teaches the use of a piezoelectric semiconductor, and no where teaches, or even suggests, that any piezoelectric, other than a semiconductor,

could be used in the Poirier invention, and, in fact, includes in the claims the express limitation to a piezoelectric semiconductor," applicant respectfully submits that the Poirier disclosure does not render the present invention obvious.

In part 5 of the Office Action mailed June 18. 2003, as part of the basis for rejecting claims 4, 5, 10, 13 and 15 under 35 U.S.C. §102(b) as being anticipated by Poirier, the examiner cited col. 4 ln. 5-9 of Poirier as disclosing resonators that "are either approximately critically coupled or over-coupled (i.e. form a band pass filter)." The cited portion of Poirier states that:

> "The input rf electrical signal is filtered by virtue of the different acoustical frequency-amplitude characteristics of the resonators 41 and 42. The extend (sic) to which these characteristics of the resonators overlap substantially determines the electrical characteristics of the filter."

Applicant respectfully submits that the above-quotation conveys the concept that only those signals are passed from the input to the output of the Poirier device which have frequencies lying both within the individual "passband" of resonator 41 and within the "passband" of resonator 42, i.e. only if the passband of resonator 41 overlaps the passband of resonator 42 will any signal pass from the input to the output of the Poirier device and only if the frequency of the signal lies within the passband of resonator 41 and also within the passband of resonator 42. I.e., Poirier states that the extent to which the "frequency-amplitude characteristic" of one resonator overlaps the "frequency-amplitude characteristic" of the other resonator determines the electrical

characteristics of the filter. Poirier is not describing the amount of acoustic coupling between the resonators as affecting the "pass-band" of the entire device, but, instead, is describing the "pass-band" of the entire device as being determined simply by the extent to which the "pass-band" of the first resonator includes frequencies that are also included within the "pass-band" of the second resonator.

In contrast to Poirier, as described in some detail paragraph 0021 of the present specification, in the present invention the number, thicknesses, and acoustic impedances of the layers of material intervening between the two resonators are carefully selected to achieve the desired degree of acoustic coupling between the two resonators.

> "The acoustic impedance of one or more layers...is adjusted or selected so as to achieve the desired degree of coupling between resonator 300 and resonator 313 to obtain a desired filter bandpass characteristic." [Spec. par. 0021, ln. 8-11.]

As described in paragraph 0022 of the Specification and depicted in Figure 8 of the present application, by selection and adjustment of the properties of the intervening layers, the resonators of the present invention can made to be acoustically under-coupled, critically coupled or over-coupled so as to exhibit the complex passbands depicted in curves 82 and 83 respectively in figure 8 of this application. Poirier does not disclose, or even suggest, the selection of the degree of acoustic coupling between the resonators so as to achieve a passband for the entire device

having the relatively sophisticated shapes depicted in curves 82 and 83 of figure 8. Accordingly, applicant respectfully submits that the disclosure in Poirier does not support the examiner's rejection of claims reciting resonators that are either approximately critically coupled or over-coupled.

The examiner rejected claims 3, 5, 10 and 15 under 35 U.S.C. §103(a) as being unpatentable over Weber in view of Poirier et al. Claims 3, 5 and 15 depend upon independent claims 1, 4 and 10 respectively. By the present amendment, claims 1, 4 and 10 have been (twice) amended and, for the reasons set forth above, are now believed to be conditioned for allowance. Accordingly, because claims 3, 5 and 15 depend upon independent claims that applicant submits are allowable, and because, for the reasons stated above, applicant also submits that claim 10 (as twice amended) is allowable, applicant respectfully submits that claims 3, 5, 10 and 15 are all in ~~conditioned~~ condition for allowance.

The examiner objected to claim 11, but indicated that claim 11 would be allowed if rewritten to include all of the limitations of claim 10 upon which it depends. Because claim 10, as now amended, is believed to be allowable, applicant submits that claim 11 is now also in ~~conditioned~~ condition for allowance.

Claim Summary

Claims 1-16 are pending

Claims 6-9, 14 and 16 were previously allowed

Claims 1-5, 10, 12, 13 and 15 were rejected

Claim 11 was objected to.

Because claims 1, 4 and 10 have been amended, and for the reasons stated above, applicant respectfully submits that all of claims 1-16 should now be allowed.

No additional fee is seen to be required.

Respectfully submitted,

Ronald M. Goldman

Ronald M. Goldman
Registration No. 24,057
Attorney for Applicant
(310) 316-5399

Date: August 7, 2003

amnd2004.fed - revised 8/4/03

(i) CLAIMS

What is claimed is:

1 (currently amended)

A microwave filter comprising:

a first piezoelectric acoustic, bulk wave, resonator having a piezoelectric layer made of an insulating material;

a second piezoelectric acoustic, bulk wave, resonator having a piezoelectric layer made of an insulating material, the second acoustic resonator being acoustically coupled to the first acoustic resonator and disposed above or below the first acoustic resonator; and

a plurality of contiguous intervening layers of differing materials located between the first acoustic resonator and the second acoustic resonator, the contiguous intervening layers acoustically coupling the first acoustic resonator with the second acoustic resonator. ~~and affecting the amount of the acoustic coupling between the first and second acoustic resonators.~~

2 (original)

The microwave filter of claim 1 wherein the first acoustic resonator and the second acoustic resonator are acoustically either approximately critically coupled or over-coupled.

3 (original)

The microwave filter of claim 2 having a signal input port and a signal output port, the first acoustic resonator being electrically connected to the signal input port and the second acoustic resonator being electrically connected to the signal output port.

4 (currently amended)

A microwave filter comprising:

a first piezoelectric acoustic, bulk wave, resonator;

a second piezoelectric acoustic, bulk wave, resonator, the second acoustic resonator being acoustically coupled to the first acoustic resonator and disposed above or below the first acoustic resonator; and

a plurality of contiguous intervening layers of differing materials located between the first acoustic resonator and the second acoustic resonator, the contiguous intervening layers acoustically coupling the first acoustic resonator with the second acoustic resonator ~~and-affecting-the-amount-of-the acoustic-coupling-between-the-first-and-second-acoustic resonators~~ and the first acoustic resonator and the second acoustic resonator being acoustically either approximately critically coupled or over-coupled.

5 (original)

The microwave filter of claim 4 having a signal input port and a signal output port, the first acoustic resonator being electrically connected to the signal input port and the second acoustic resonator being electrically connected to the signal output port.

6 (previously presented)

A microwave filter comprising:

a first piezoelectric acoustic, bulk wave, resonator;

a second piezoelectric acoustic, bulk wave, resonator acoustically coupled to the first acoustic resonator and disposed

above or below the first acoustic resonator;

a third piezoelectric acoustic, bulk wave, resonator electrically connected to the second acoustic resonator;

a fourth piezoelectric acoustic, bulk wave, resonator acoustically coupled to the third acoustic resonator and disposed above or below the third acoustic resonator;

a first plurality of contiguous intervening layers of differing materials located between the first acoustic resonator and the second acoustic resonator and affecting the amount of the acoustic coupling between the first and second acoustic resonators; and

a second plurality of intervening layers of material located between the third acoustic resonator and the fourth acoustic resonator and affecting the amount of the acoustic coupling between the third and fourth acoustic resonators.

7 (original)

The microwave device of claim 6 in which the first, second, third and fourth acoustic resonators each has a piezoelectric layer made of an insulating material.

8 (original)

The microwave device of claim 6 having a signal input port and a signal output port, the first acoustic resonator being connected to the signal input port and the fourth acoustic resonator being connected to the signal output port.

9 (original)

The microwave device of claim 6 in which at least two of the acoustic resonators include piezoelectric layers of material and electrodes, each of said resonators having a resonant frequency, at least one electrode of the first one of said at least two acoustic resonators having a thickness that differs from the thickness of at least one of the electrodes in the second resonator of said at least two acoustic resonators thereby offsetting the resonant frequency of the first one of said at least two acoustic resonators from the resonant frequency of the second one of said at least two acoustic resonators.

10 (currently amended)

A microwave filter having a signal input port and a signal output port and comprising:

a first acoustic, bulk wave, resonator that includes a piezoelectric layer of material, the first acoustic resonator being electrically connected to the signal input port;

a second acoustic, bulk wave, resonator acoustically coupled to the first resonator and disposed above or below the first acoustic resonator;

a third acoustic, bulk wave, resonator that includes a piezoelectric layer of material and that is acoustically coupled to the second resonator and disposed above or below the second acoustic resonator, the third acoustic resonator being electrically connected to the signal output port and the second acoustic resonator being located between the first and third acoustic resonators;

a first plurality of contiguous intervening layers of differing materials located between the first acoustic resonator and the second acoustic resonator<u>, the first plurality of contiguous intervening layers acoustically coupling the first acoustic resonator with the second acoustic resonator</u> ~~and affecting-the-acoustic-coupling-between-the-first-and-second acoustic-resonators~~;

a second plurality of contiguous intervening layers of differing materials located between the second and third acoustic

resonators, the second plurality of contiguous intervening layers acoustically coupling the second acoustic resonator with the third acoustic resonator. ~~and affecting the acoustic coupling between the second and third acoustic resonators.~~

11 (original)

The microwave filter of claim 10 in which the second acoustic resonator includes a piezoelectric layer of material and bounding electrodes and in which the second acoustic resonator is electrically connected to an external load.

12 (original)

The microwave filter of claim 1 and further comprising:

a substrate;

an acoustic reflector; and

the first and second acoustic resonators and the plurality of intervening layers being supported upon the substrate by the acoustic reflector.

13 (original)

The microwave filter of claim 4 and further comprising:

a substrate;

an acoustic reflector; and

the first and second acoustic resonators and the plurality of intervening layers being supported upon the substrate by the acoustic reflector.

14 (original)

The microwave filter of claim 6 and further comprising:

a substrate;

an acoustic reflector; and

the first, second, third and fourth acoustic resonators and the first and second plurality of intervening layers being supported upon the substrate by the acoustic reflector.

15 (original)

The microwave filter of claim 10 and further comprising:

a substrate;

an acoustic reflector; and

the first, second and third acoustic resonators and the first and second plurality of intervening layers being supported upon the substrate by the acoustic reflector.

16 (previously presented)

An microwave acoustic device fabricated upon a wafer comprising:

a first microwave filter fabricated upon the wafer and having a pass-band frequency and the first microwave filter comprising:

a first piezoelectric acoustic, bulk wave, resonator having a conducting electrode;

a second piezoelectric acoustic, bulk wave, resonator, the second acoustic resonator being acoustically coupled to the

first acoustic resonator and disposed above or below the first acoustic resonator; and

a plurality of contiguous intervening layers of differing materials located between the first acoustic resonator and the second acoustic resonator and affecting the amount of the acoustic coupling between the first and second acoustic resonators;

and a second microwave filter fabricated upon the wafer and having a pass-band frequency and the second microwave filter comprising:

a first piezoelectric acoustic, bulk wave, resonator having a conducting electrode;

a second piezoelectric acoustic, bulk wave, resonator, the second acoustic resonator being acoustically coupled to the first acoustic resonator and disposed above or below the first acoustic resonator; and

a plurality of contiguous intervening layers of differing materials located between the first acoustic resonator and the second acoustic resonator and affecting the amount of the acoustic coupling between the first and second acoustic resonators;

wherein the thickness of the conducting electrode in the first piezoelectric resonator of the first microwave filter differs from the thickness of the conducting electrode in the first piezoelectric resonator of the second microwave filter, whereby said difference in thicknesses causes the pass-band frequency of the first microwave filter to be shifted relative to the pass-band frequency of the second microwave filter.

claim-5.fed - revised 8-4-03